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CONE-LIKE STROBILI ATTACHED TO A *PHYLLOTHECA*-  
LIKE FOLIAGE.

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(Plates i.-ii.)

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MANY years have elapsed since the late Professor Sir F. McCoy drew attention to what he considered the inflorescence of *Phyllothea*,<sup>1</sup> notwithstanding that he misunderstood its nature. Since 1847, the year in which McCoy wrote, Heer and Schmalhausen have both described strobili, believed by them to be the reproductive condition of this interesting and widely distributed Permo-Carboniferous plant. The announcement has lately been made that Professor R. Zeiller has, or is about to publish, additional information afforded by specimens from Asia Minor.

To render the account of the little fossils now under consideration clear, it will be necessary to review the descriptions of the parts referred to by the authors mentioned.

McCoy's inflorescence consisted of a "portion of a branch with the joints more approximate than on other parts of the plant, their length being scarcely equal to their diameter; the sheaths are the exact length of the internodes, and fringed on their upper margin with a dense little whorl of (I think two-celled) anthers." To judge by the figure only, I am inclined to say that the inflorescence consisted of a stem giving support to stalked structures bearing sporangiophores, without the intervention of intermediate sterile bracts, thus approximating to the strobilus of *Equisetum*.

Mr. Schmalhausen figured<sup>2</sup> two forms of fructification somewhat different from one another, as those of *Phyllothea deliquescentis*, Göpp. One of these<sup>3</sup> consists of a loose strobilus in the form of a stem bearing clusters of peltate and stalked appendages (sporangiophores), between whorls of sterile leaves or bracts. The other figure<sup>4</sup> differs from the first in so far that sterile bracts alternating with the fruit-bearing organs appear to be absent. On the first

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<sup>1</sup> McCoy—Ann. Mag. Nat. Hist., xx., 1847, p. 155.

<sup>2</sup> Schmalhausen—Beiträge Jura-Flora Russlands, 1879, p. 68, pl. ix., figs. 16-17.

<sup>3</sup> *Loc. cit.*, figs. 16, 16a.

<sup>4</sup> *Loc. cit.*, fig. 17.

of these illustrations Count Solms-Laubach makes<sup>5</sup> the following remarks: "A striated axis with sheaths thoroughly like those of *Phyllothea*, bears on the internodes between the sheaths in a lateral position certain small organs, which are exactly like the sporangiferous peltate disks of our *Equiseta*." In the words<sup>6</sup> of Seward, "in *Phyllothea* the sporangiophores appear to have been given off in whorls, which were separated from one another by whorls of sterile bracts, whereas in *Equisetum* there are no sterile appendages associated with the sporangiophores of the strobilus with the exception of the annulus at the base of the cone."

In the case of McCoy's illustration, if the presence of intermediate sterile or normal leaves could be shown to exist, which is certainly not shown on the figure, the correspondence with Schmalhausen's illustration would be very close, the supposed "anthers" being probably equivalent to the sporangiophores. The absence of these organs indicates in McCoy's *Phyllothea* a much nearer approach to the wholly fertile whorls in the strobilus of *Equisetum*.

In 1880, the late Prof. Oswald Heer figured<sup>7</sup> two cones in contiguity to a *Phyllothea*-like stem from Siberia, on which Solms-Laubach remarks<sup>8</sup>:—"Heer is not justified in uniting with his *Phyllothea sibirica* two spikes of another species . . . merely because they lie beside it on the specimen." It would appear from this that these cones have nothing to do with *Phyllothea*.

A further instance of inflorescence has been discovered by Prof. R. Zeiller<sup>9</sup> in connection with *Phyllothea* remains from Asia Minor, but I have not access to his description. The strobili are said to resemble the long and narrow cones of *Annularia*, composed of linear lanceolate sterile bracts and sporangiophores, and therefore in no great degree differing from Schmalhausen's description and figures.

To sum up, and discarding Heer's cones, it may be stated that at least two satisfactory instances of fertile shoots are known in *Phyllothea*-like plants—that of *P. deliquescens* (Göpp.), Schmalhausen, and *P. ralli*, Zeiller; probably a third—that of the Australian plant figured by McCoy; and possibly even a fourth exists in the form of the *Cingularia*-like foliage, introduced to notice<sup>10</sup> some time ago by myself. It is a very remarkable fact, when we consider the hundreds of *Phyllothea* fragments that have been

<sup>5</sup> Solms-Laubach—Fossil Botany by Garnsey and Balfour, 1891, p. 181.

<sup>6</sup> Seward—Fossil Plants, i., 1898, p. 286.

<sup>7</sup> Heer—Flora Foss. Arctica, vi., abth. 1, 1880, pl. i., fig. 5 b and c.

<sup>8</sup> Solms-Laubach—Fossil Botany by Garnsey and Balfour, 1891, p. 181.

<sup>9</sup> Seward—Fossil Plants, i., 1898, p. 282.

<sup>10</sup> Rec. Geol. Surv. N.S.W., iv., 4, 1895, p. 151.

unearthed in the Upper Coal Measures of New South Wales, and distributed throughout the world since 1828, when Brongniart first named<sup>11</sup> the type *P. australis*, that during this lengthened period, McCoy's example is the only trace of actual fructification recorded in an Australian specimen.

Under these circumstances it naturally affords me great pleasure to describe from the Upper Coal Measures at Newcastle, compact cones attached to a *Phyllothea*-like stem and foliage, differing entirely in aspect from the loose strobili mentioned by Schmalhausen, Solms-Laubach, and Seward.

There are five well formed cones, varying from seven millimetres to thirty millimetres in length. The associated stems and leaves are to my eye identical with a figure termed by Dr. O. Feistmantel *P. australis*, Brong.,<sup>12</sup> in which the stem and branches are divided into semi-vase like internodes (Plate i., fig. 2; Pl. ii., fig. 4). Similar stem or branch portions are scattered over the surface of the specimens, accompanied by the cones under description, and in one case with one of the smaller cones attached.

In the different stem fragments the internodes are from five to ten millimetres long, and an average pressure diameter of three to four millimetres. Each internode expands somewhat from below upwards; the sheaths are short, but seem to be strong, and give support to at least twenty long linear and delicate uninervate leaves, which do not cling to or embrace the stem, but radiate at a low angle in a very free and open manner, forming, when seen in elevation, gracefully curved outlines (Pl. i., fig. 4; Pl. ii., fig. 5). There are other larger stem fragments on the same pieces of shale, and of which the smaller portions may be the branches.

The state of preservation of the cones does not lend itself to detailed description. They are bi-pyramidal or elongately-pyriform, attached by a narrow short pedicel to the last node of the branch, densely clothed with small linear leaves, which differ very markedly from the ordinary leaves springing from the sheaths in their size and extreme delicacy. The structure of the respective examples is as follows:—

(1.) The smallest cone (Pl. i., fig. 2) is seven millimetres long, slender, elongately-pyriform, and is attached to a portion of a branch. It is clothed with the comparatively long upwardly streaming leaves already described, but no other characters can be made out.

(2.) This cone (Pl. i., fig. 3) is shorter and broader than the first, unequally bi-pyramidal, the lower portion assuming a pedunculate appearance. It is fourteen millimetres long, just double that of the former. Again nothing is visible but the leaf clothing.

<sup>11</sup> Brongniart—Prodrome, 1828, p. 152.

<sup>12</sup> Palaeontographica, Sup. Bd. iii., Lief. 3, Heft 2, 1878, pl. vii., fig. 1.

(3.) This (Pl. i., fig. 1) is the largest of the three small cones, and is eighteen millimetres in length. Under the coaly pellicle which practically constitutes the fossil, the shale is impressed with narrow transverse node-like constrictions, from which the leaves spring in upward succession, streaming above the apex of the cone.

(4.) The smallest of the two larger cones (Pl. ii., fig. 2) is twenty-seven millimetres long by thirteen wide (as compressed). Here the nodal lines are very apparent, each giving support to a row of delicate leaves, rather broad at the base, but fine and acicular above. The apical portions are bent outwards at an acute angle, and are visible at the sides of the cone.

(5.) The fifth cone (Pl. ii., fig. 1) only differs from the last slightly in size, otherwise exhibiting precisely the same characters; it is thirty millimetres long, and seventeen broad.

It is unfortunate that neither of these organs is seen in longitudinal section, nor wholly denuded of its bracts. The more intimate structure is therefore inaccessible, and it is impossible to say with certainty whether the verticils of leaves are sterile bracts alternating with fertile organs (sporangio-phores) concealed or no. Nor, under these circumstances, can it be surmised whether these strobili agree in their structure with the loose strobilus of *Equisetum* on the one hand, or with the more complex fructification ascribed by authors to *Phyllothea*.

The loose strobilus figured by Schmalhausen as that of *P. deliquescens*, notwithstanding that the whorls of peltate organs were protected by the alternating cycles of sterile bracts, would hardly prepare one for the appearance of these close cone-like strobili. The former we can picture as longitudinally elongate and narrow bodies, very different in appearance to the present cones. Just at the point this inquiry becomes especially interesting, it has to be abandoned, temporarily it is to be hoped, however. All that can be advanced at present is that, just as one form of *Phyllothea*-like plant is associated in our Upper Coal Measures with a *Cingularia* foliage; so another, equally *Phyllothea*-like, produces cone-like strobili, differing in outward appearance, at least, from what one would have anticipated.

As a matter of general resemblance only, attention may be called to the cone of *Macrostachya*, which—allowing for the more elongated form, and the short acicular terminations of the bracts, instead of the long bent over apices in our cones—presents an unmistakable resemblance.

The specimens are from the Upper Coal Measures (Permian-Carboniferous) at Shepherd's Hill, Newcastle, and were collected by Messrs. John Mitchell and C. Hedley.

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